



Record of the beet fly *Pegomyia yoscyami* (Diptera: Anthomyiidae) and relation with its larval – pupal parasitoid *Opius nitidulator* (Hymenoptera: Braconidae) in Kafr EL-Sheikh Governorate

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ARTICLE INFO

Article History

Received: 27/ 9/ 2019

Accepted: 1 / 12/2019

Keywords

Beet fly, *Pegomyia hyoscyami*, parasitoid, *Opius nitidulator*, parasitism, control and Kafr EL-Sheikh Governorate.

Abstract:

All previous researches since 1981 (where sugar beet cultivation began in Egypt) till now - mentioned that the beet fly is *Pegomyia mixta* Vill. (Diptera: Anthomyiidae) infested sugar beet fields at Kafr El-Sheikh Governorate. But, this work demonstrates that there is another sibling species of beet fly *Pegomyia hyoscyami* (Panzer) (Diptera: Anthomyiidae). It was reared on sugar beet plants. The current study was carried out at Al-Nataf Village, Kafr El-Sheikh Governorate during two successive seasons 2017 / 2018 and 2018/ 2019 to assessment the role of the parasitoid; *Opius nitidulator* Nees (Hymenoptera: Braconidae) attacking larval stage of *P. hyoscyami* by collected 15 blotches (one blotch contain 2 to 5 larvae) per sample/ month and the correlation coefficient values between *P. hyoscyami* populations and its larval – pupal parasitoid *O. nitidulator* was carried out. The obtained data showed that the individuals of *P. hyoscyami* form 98.25% and 98.08% out of the total number of flies in both seasons, respectively. Whereas, the larval-pupal parasitoid, *O. nitidulator* constitute 100 and 100% out of the total populations in the two seasons. Statistical analysis indicated that a highly positive significant correlation between *P. hyoscyami* and its parasitoid. Values of "r" were 0.993 and 0.937 in both seasons, respectively.

Introduction

Sugar beet *Beta vulgaris* L. (Family: Chenopodiaceae) is a main source of sugar in Egypt and all over the world. In Egypt, the total area cultivated with sugar beet crop reached about 600000 feddans in 2018/2019 season, from which about 25% was cultivated in Kafr El-Sheikh Governorate (Ministry of Agriculture and Land Reclamation, 2018). The sugar beet fly *Pegomyia mixta* Vill.

(Diptera: Anthomyiidae) is one of the most prevalent and destructive insect of sugar beet crop which causing a substantial reduction in sugar content (40.50%) and root weight (31.50%) (Metwally *et al.*, 1987). Many reviewers surveyed this insect pest on sugar beet cultivation since 1981 (where sugar beet cultivation began in Egypt) till now in Kafr El-Sheikh Governorate (Abo-Saied, 1987;

Abou-Attia, 1999; Mesbah, 2000; Bazazo, 2010; El- Mahalawy, 2011; Bazazo *et al.*, 2015 and El-Dessouki, 2019).

Opius nitidulator Nees (Hymenoptera : Braconidae) was recorded as internal larval parasitoid on beet fly attacking the full grown larvae before pupation and one adult parasitoid emerges individually from the host pupa (Ewais, 1990; Hassanein *et al.*, 1993; Awadalla, 1997; El-Serwy, 2008; Bazazo, 2010 and Bazazo *et al.*, 2017). Mousa (2005) indicated that braconid endoparasitoid was a main factor in regulating the population density of beet fly in sugar beet fields.

This current investigation in the first study in Kafr El-Sheikh Governorate to identify this new record species of the beet fly *P. hyoscyami*. Also, this study showed the correlation coefficient values between *P. hyoscyami* populations and its larval-pupal parasitoid, *O. nitidulator*.

Materials and Methods

The current study was conducted at Al-Nataf village, Kafr El-Sheikh Governorate during two successive seasons 2017/2018 and 2018/2019. About half feddan was cultivated with sugar beet variety (Pyramids) on 20th October in both seasons. Recommended agricultural practices of sugarbeet cultivation were achieved, and application of insecticides was excluded throughout the whole season.

1. The percentages of parasitism and emerged fly adults:

Fifteen blotches (one blotch contain 2 to 5 larvae) per sample every month from late December to early May in two seasons were randomly collected and transferred to the laboratory and kept in five petri dishes (9 cm), containing filter papers, until pupation. Newly pupae were put in other petri dishes till adult stage emergence (fly or parasitoid).

The numbers of pupae, parasitoid and fly adult were recorded and the percentages of parasitism were calculated. Sampling started on 20th December and repeated every month for the first season till 14th May and 21st December until 10th May for the second season.

2. Identification of insect samples:

The adult of fly and its parasitoid were taken by a file brush and put in small vials containing alcohol 70%, after that these samples transferred to Insect Identification Unit – Plant Protection Research Institute – Giza – for identification by aid Prof. Dr. Ayman Ibrahim.

3. Statistical analysis:

Simple correlation coefficient values between *P. hyoscyami* and its parasitoid, *O. nitidulator* during the two seasons were calculated according to Snedecor and Cochouran (1989).

Results and discussion

1. Recording the percentages of emerged fly adults and parasitism by *Opius nitidulator*:

Data in Tables (1 and 2) indicated that the percentages of parasitism caused by *O. nitidulator* on sugar beet fly *P. hyoscyami* ranged between 16.67 to 40.90% and 0.00 to 52.38% in 2017/2018 and 2018/2019 seasons, respectively. While, the average of parasitism during the whole season were 36.36% and 36.25% in both seasons, respectively. Also, the percentages of emerged fly adults, *P. hyoscyami* ranged between 59.10 to 83.33% and 47.62 to 100.00% in 2017/2018 and 2018/2019 seasons, respectively. Whereas, the average of emerged fly adults during the whole season were 63.64% and 63.75% in two seasons, respectively.

Table (1): Percentages of emerged fly adults and parasitism during 2017/2018 season, per 15 blotches per sample/monthly.

Date of examination	No. of pupae	No. of parasitoid	% of parasitism	No. of fly adults	% of emerged fly adults
20/12/2017	6	1	16.67	5	83.33
21/1/2018	9	3	33.33	6	66.67
22/2/2018	10	3	30.00	7	70.00
24/3/2018	15	6	40.00	9	60.00
25/4/2018	22	9	40.90	13	59.10
14/5/2018	26	10	38.46	16	61.54
Total	88	32	36.36	56	63.64

Table (2): Percentages of emerged fly adults and parasitism during 2018/2019 season, per 15 blotches per sample/monthly.

Date of examination	No. of pupae	No. of parasitoid	% of parasitism	No. of fly adults	% of emerged fly adults
21/12/2018	4	0	0.00	4	100.00
23/1/2019	6	2	33.33	4	66.67
25/2/2019	14	4	28.57	10	71.43
22/3/2019	16	5	31.25	11	68.75
26/4/2019	19	7	36.84	12	63.16
10/5/2019	21	11	52.38	10	47.62
Total	80	29	36.25	51	63.75

These results demonstrated that the beet fly *P. hyoscyami* is a new record insect species on sugar beet plants in Kafr El-Sheikh Governorate. As the authors aware, this study is the first investigation on this insect species and very little literature is known about it in sugar beet fields at Kafr El-Sheikh Governorate. Anonymous (2019) reported that *P. hyoscyami*, the beet leaf miner or spinach leaf miner is a grey fly about (0.24 inch) long (Figure,1). It lays egg

masses on the undersides of leaves of beet plants. Every egg masses contain (2 to 5 eggs) develop into larvae that burrow into the leaf hollowing out large patches of the leaf between leaf surfaces, often damage large parts of the leaf Figure (2). Saiko (1976) showed that *P. hyoscyami* is a sibling species to *P. betae* and *P. mixta*. Angelova (2007) demonstrated that *P. hyoscyami* is found in Egypt, and *O. nitidulator* an important parasitoid to its larvae.

**Figure (1): Larvae and adult of *Pegomyia hyoscyami*.****Figure (2): Infection symptoms of *Pegomyia hyoscyami*.**

2. Correlation coefficient values between *Pegomyia hyoscyami* and its parasitoid *Opius nitidulator* during 2017/2018 and 2018/2019 seasons:

Correlation coefficient values were calculated considering the record of the percentages of emerged fly adults and percentages of parasitism were found in Tables (1 and 2). Data presented in Table (3) indicated that a highly positive significant

Table (3): Correlation coefficient values between *Pegomyia hyoscyami* and its parasitoid *Opius nitidulator*.

Seasons	<i>Pegomyia hyoscyami</i> X <i>Opius nitidulator</i>	
	"r" value	Status of significant
2017/2018	0.993**	Highly significant, P < 0.01
2018/2019	0.937**	Highly significant, P < 0.01

3. Identification of insects by insect identification unit, Agricultural Research Center:

The results illustrated in Table (4) showed that the individuals of *O. hyoscyami* form 98.25% and 98.08% out of the total

Table (4): Identification of insect specimens, during 2017/2018 and 2018/2019 seasons.

Seasons	Total of pupae	Parasitoid			Flies adult		
		No.	Species	%	No.	Species	%
2017/2018	88	32	<i>Opius nitidulator</i>	100%	57	<i>Pegomyia hyoscyami</i> (56)	98.25
						<i>Pegomyia mixta</i> . (1)	1.75
2018/2019	80	29	<i>Opius nitidulator</i>	100%	52	<i>Pegomyia hyoscyami</i> (51)	98.08
						<i>Pegomyia mixta</i> (1)	1.92

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correlation between *P. hyoscyami* and its parasitoid, *O. nitidulator* in two seasons. Values of "r" were 0.993 and 0.937 in 2017/2018 and 2018/2019 seasons, respectively.

These results showed that *O. nitidulator* as a main factor in regulating the population numbers of *P. hyoscyami* in sugar beet fields at Kafr El-Sheikh Governorate.

numbers in two seasons, respectively. Whereas, the larval – pupal parasitoid, *O. nitidulator* constitute 100% out of the total individuals in two seasons according to Insect Identification Unit–Plant Protection Research Institute, Agricultural Research center.

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